GreenSTEP: Greenhouse Gas Statewide Transportation Emissions Planning Model

Innovations in Travel Modeling 2010
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Plenary Session S2: The Raison d'etre of Travel Modeling
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Changes in the Raison d'etre of Travel Modeling

Travel Modeling Past

Reasons for Modeling

- Planning road expansions
- Planning transit expansions
- Analyzing land use changes
- Air quality

Social and Environmental Context

- Increasing "automobility"
  - Increasing auto ownership
  - Focus on expansion of road system
- Expansion of labor force, household incomes, consumption
- Increasing congestion

Travel Modeling Future

Social and Environmental Context

- Greenhouse gas (GHG) emissions and climate change
- Resource depletion, scarcity, environmental impacts
- Saturation of automobility (in the U.S.)
- Declining birth rates, increasing median age

Reasons for Modeling

- Managing vehicle travel and emissions from vehicle travel
- Integrating land use and transportation decisions
- Planning for low carbon transportation vehicles & modes
- Planning for affordable accessibility

Travel Modeling Approaches Need to Change

The fundamental changes in the priorities and challenges of planning caused by climate change and energy scarcity will have significant impacts on the philosophy and method of urban modelling:

- non-marginal rather than marginal changes
- less reliance on observed behavior
- more attention to strong theory
- less choice but more constraints
- less statistical calibration, more plausibility analysis
- less detail but more comprehensiveness
- fast models to allow many exploratory scenarios
- etc.

Michael Wegener

The GreenSTEP Model

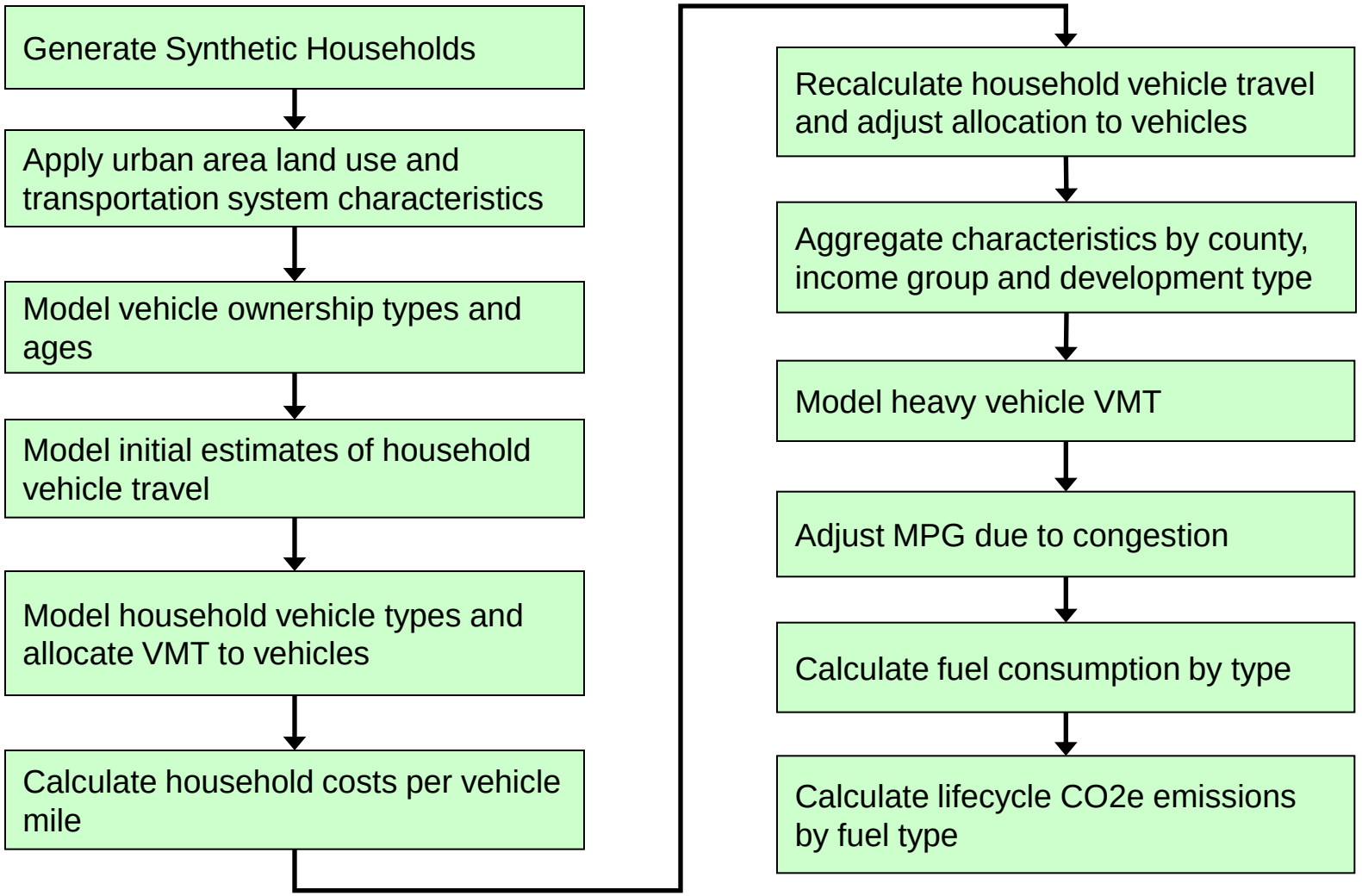
Background

- GreenSTEP = Greenhouse gas State Transportation Emissions Planning model
- Work started (2008) at the request of the Oregon Global Warming Commission (OGWC) for a model to evaluate a broad range of GHG policies
- GreenSTEP is a strategic planning model:
  - Broad (comprehensive) scope
  - Behavioral but with less detail
  - Logical (theoretical) components to address behavior where data is limited
  - Fast enough to allow more complete exploration of the problem space

GreenSTEP Policy Sensitivity

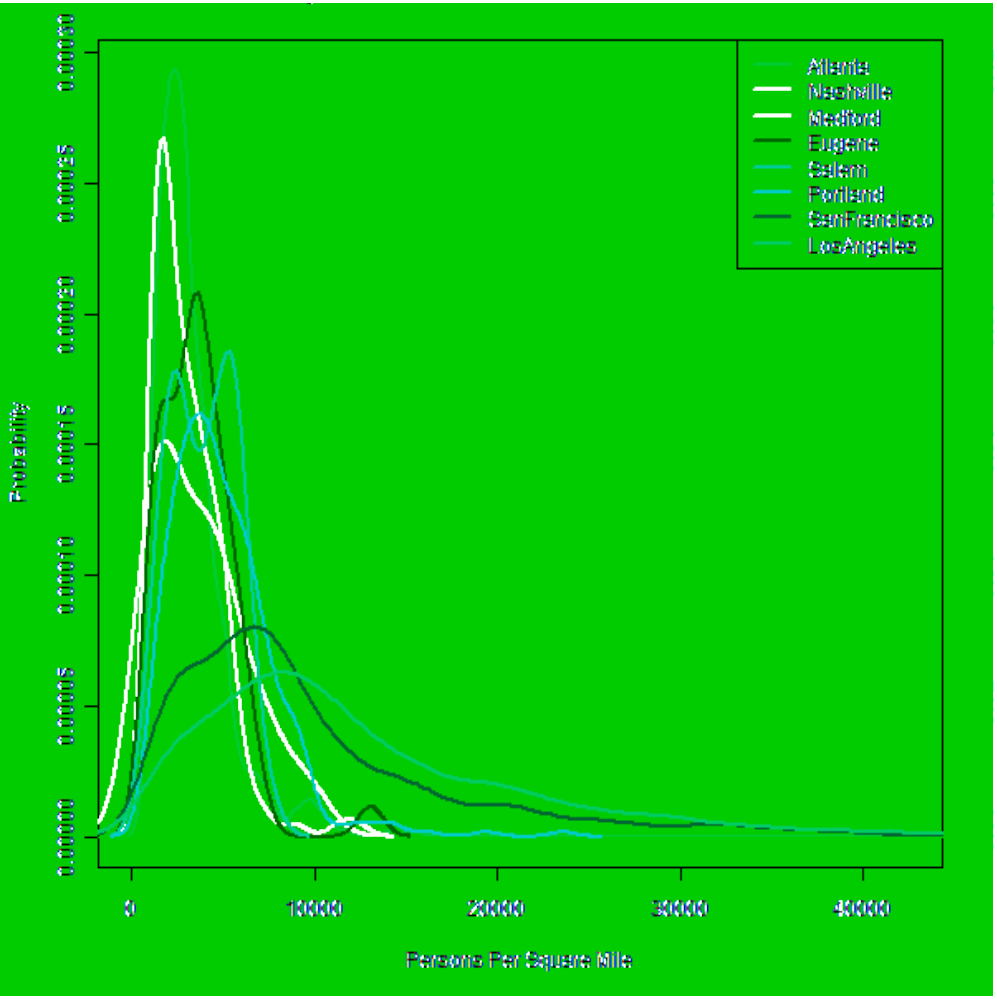
- Demographic and income changes
- Relative amounts of development occurring in urban and rural areas
- Metropolitan and other urban area densities
- Urban form
- Amounts of metropolitan area public transit service
- Highway capacity
- Vehicle proportions: autos, light trucks, EVs, plug-in HEVs, lightweight EVs
- Vehicle ages
- Vehicle fuel efficiency
- Pricing of fuel, carbon, VMT, parking
- TDM and eco-driving
- Effects of congestion on fuel economy
- Lifecycle carbon content of fuels
- CO2 production from electrical power use for transportation

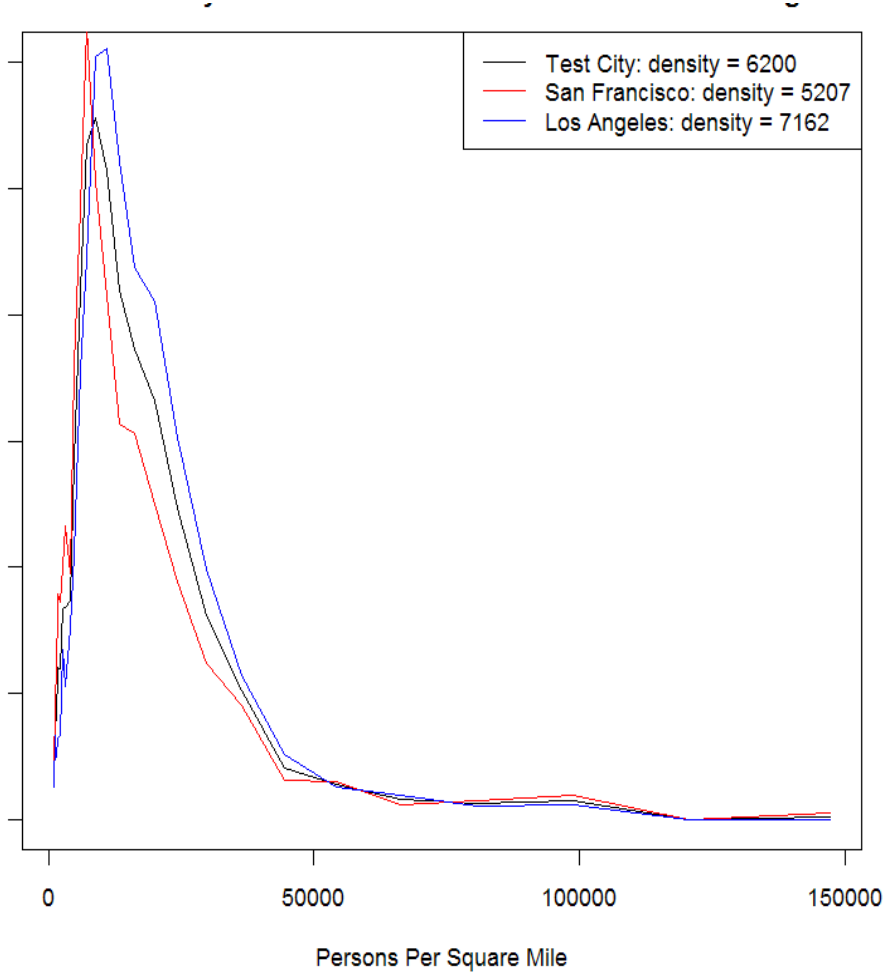
GreenSTEP Design Overview



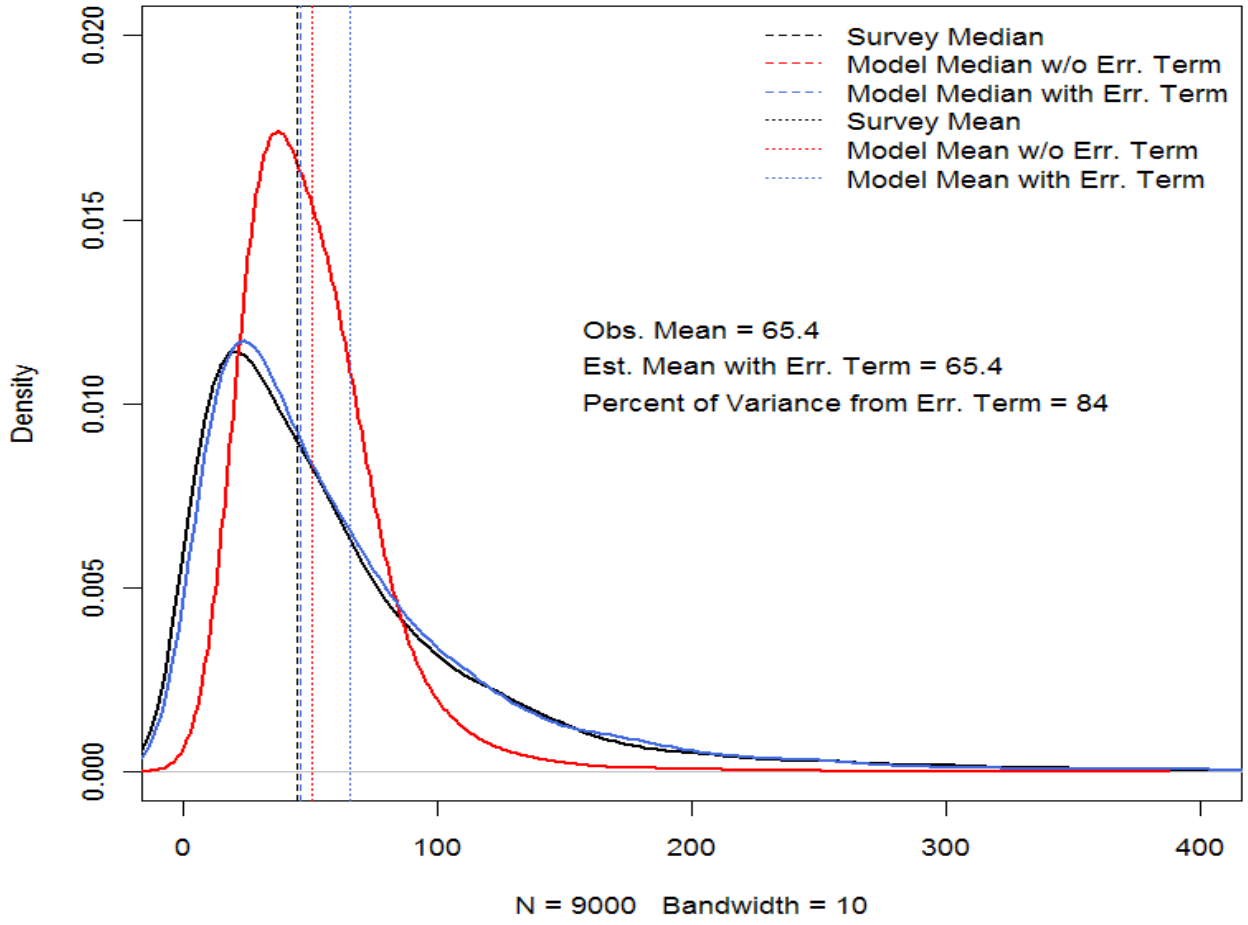
GreenSTEP Approaches to GHG Strategic Modeling Challenges

How do you represent "detailed" (tract level) land use attributes in a statewide strategic model?

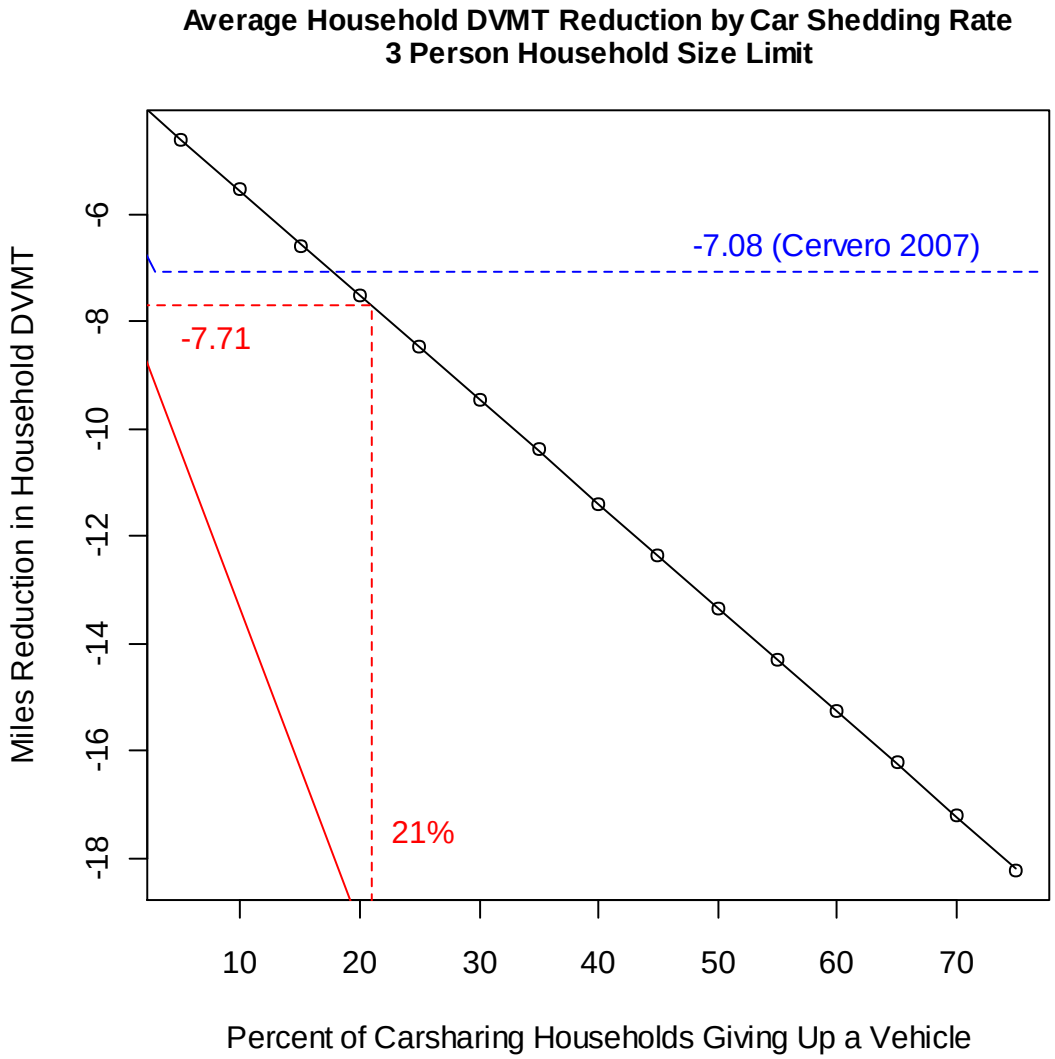




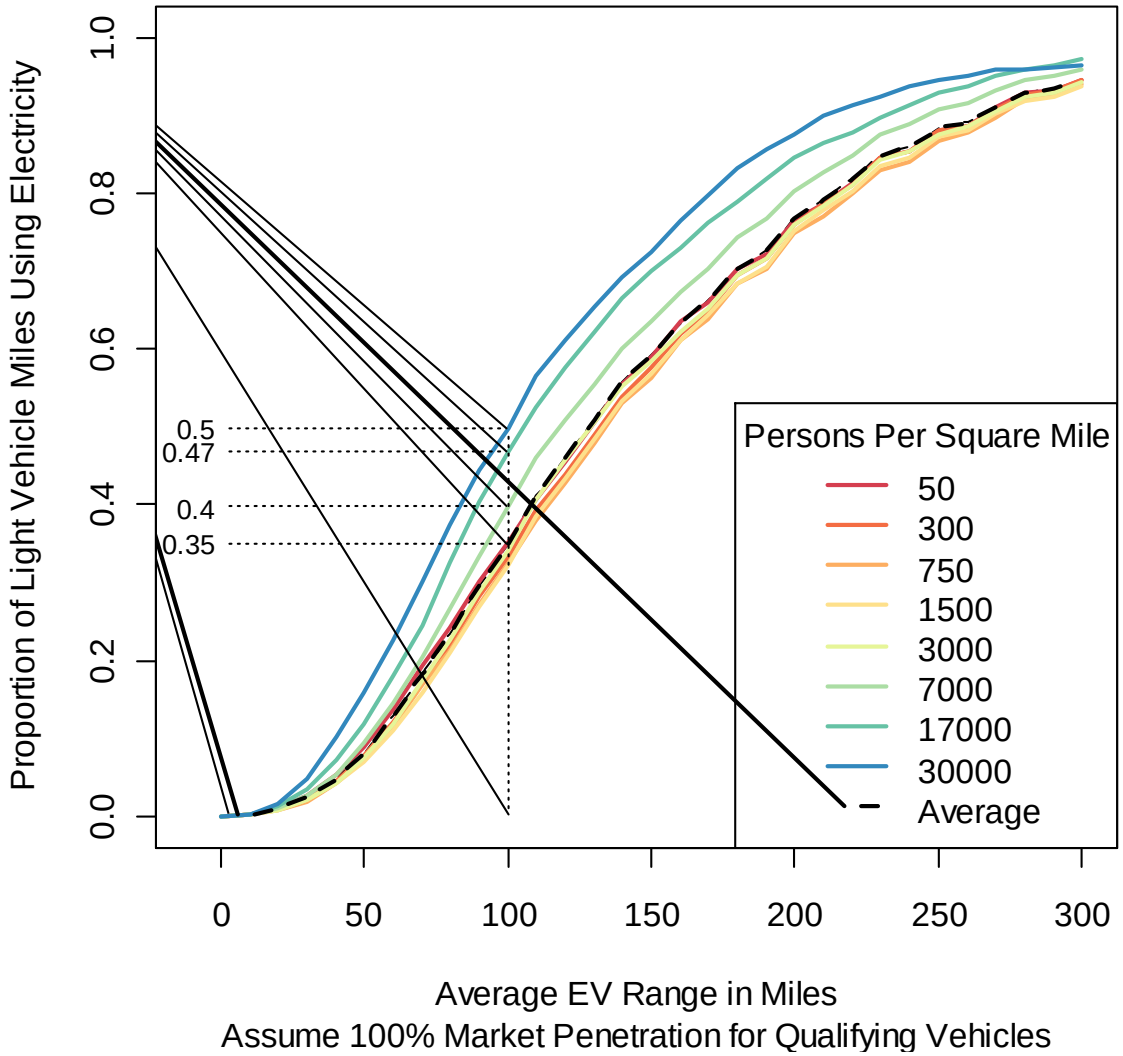
How do you address day-to-day travel variability which is important to to the assessment of GHG policies but not captured by many travel surveys?



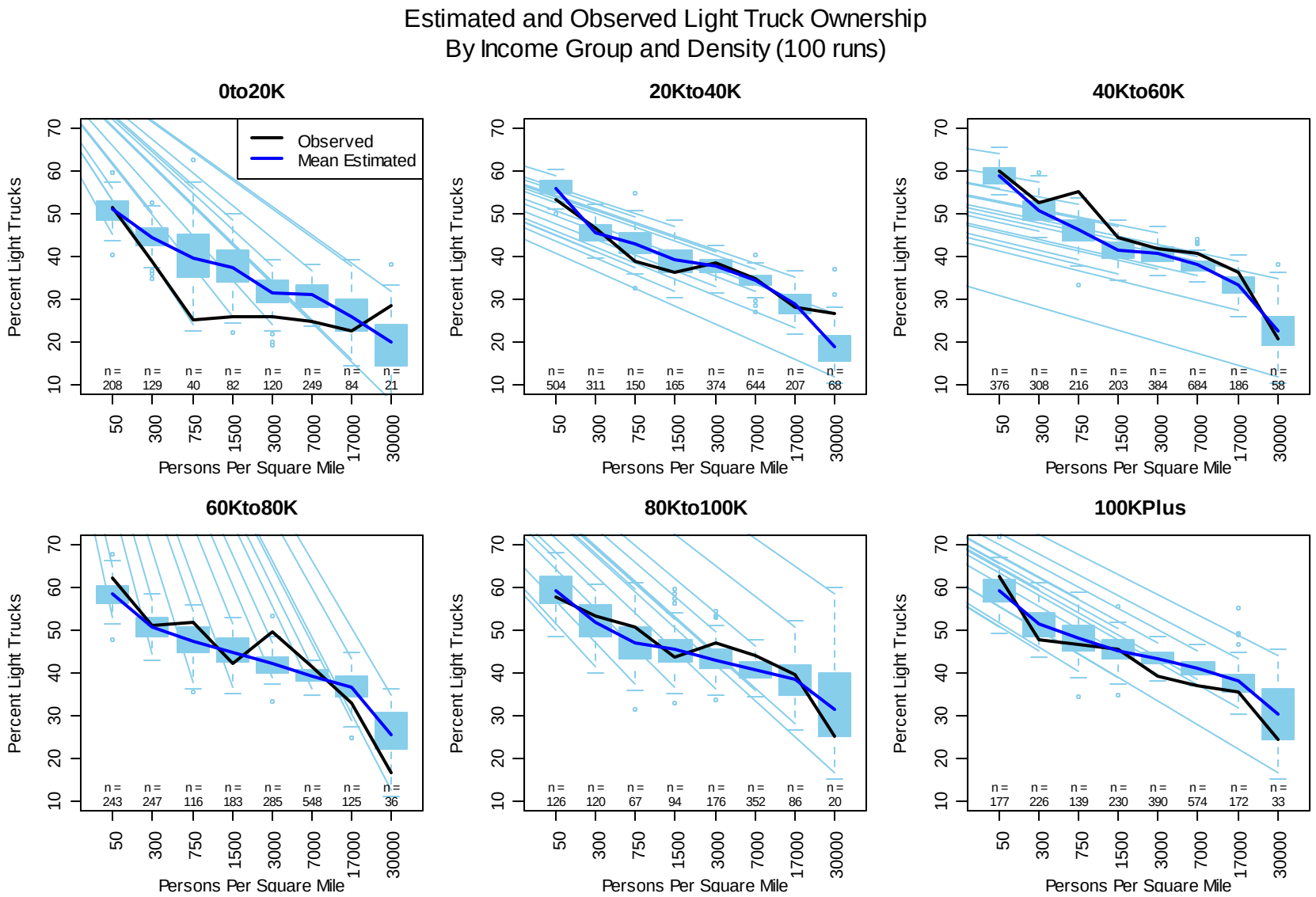
How do you model emerging or anticipated trends for which there is insufficient data to develop a statistical model?



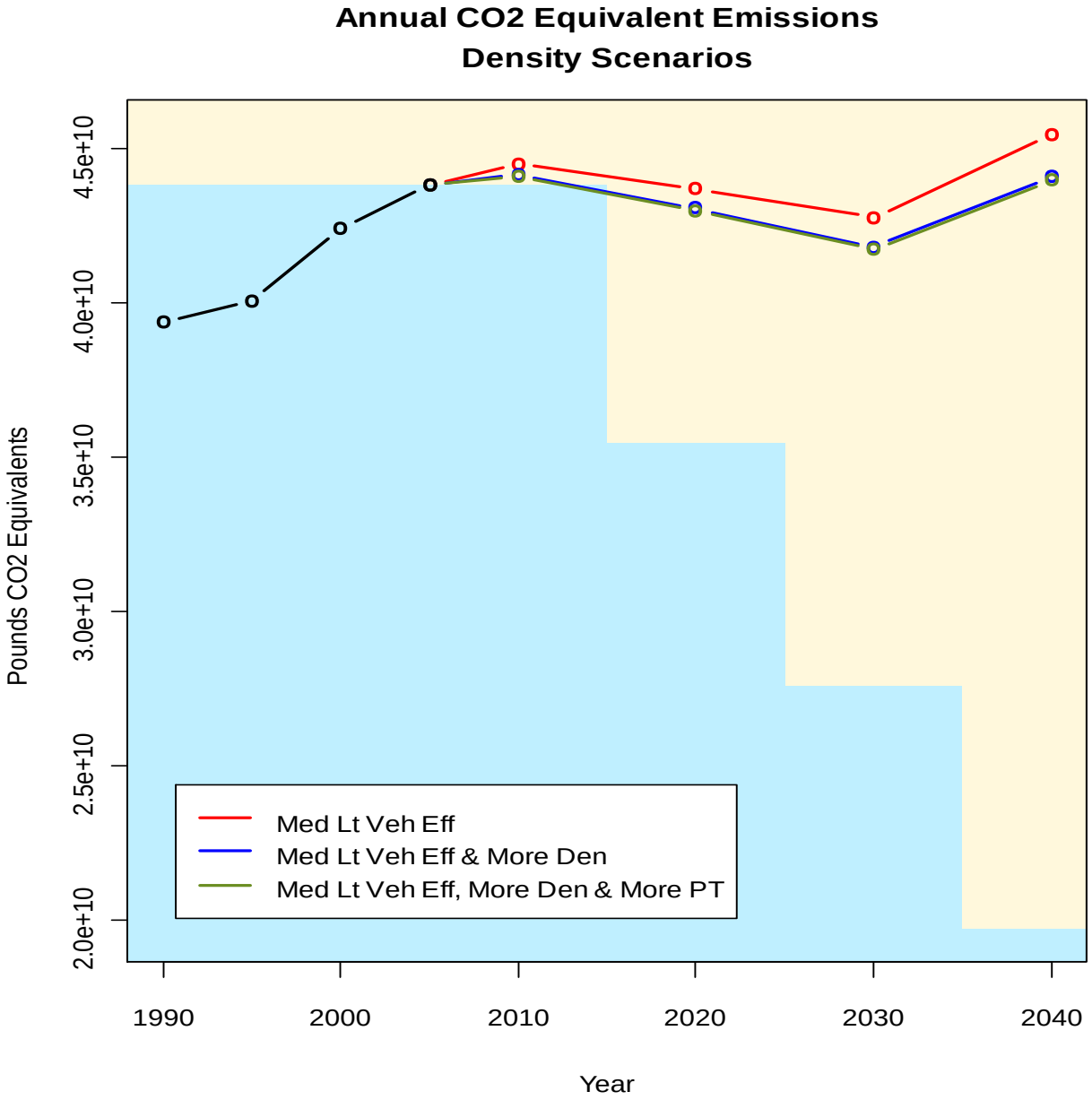
How do you model something new?

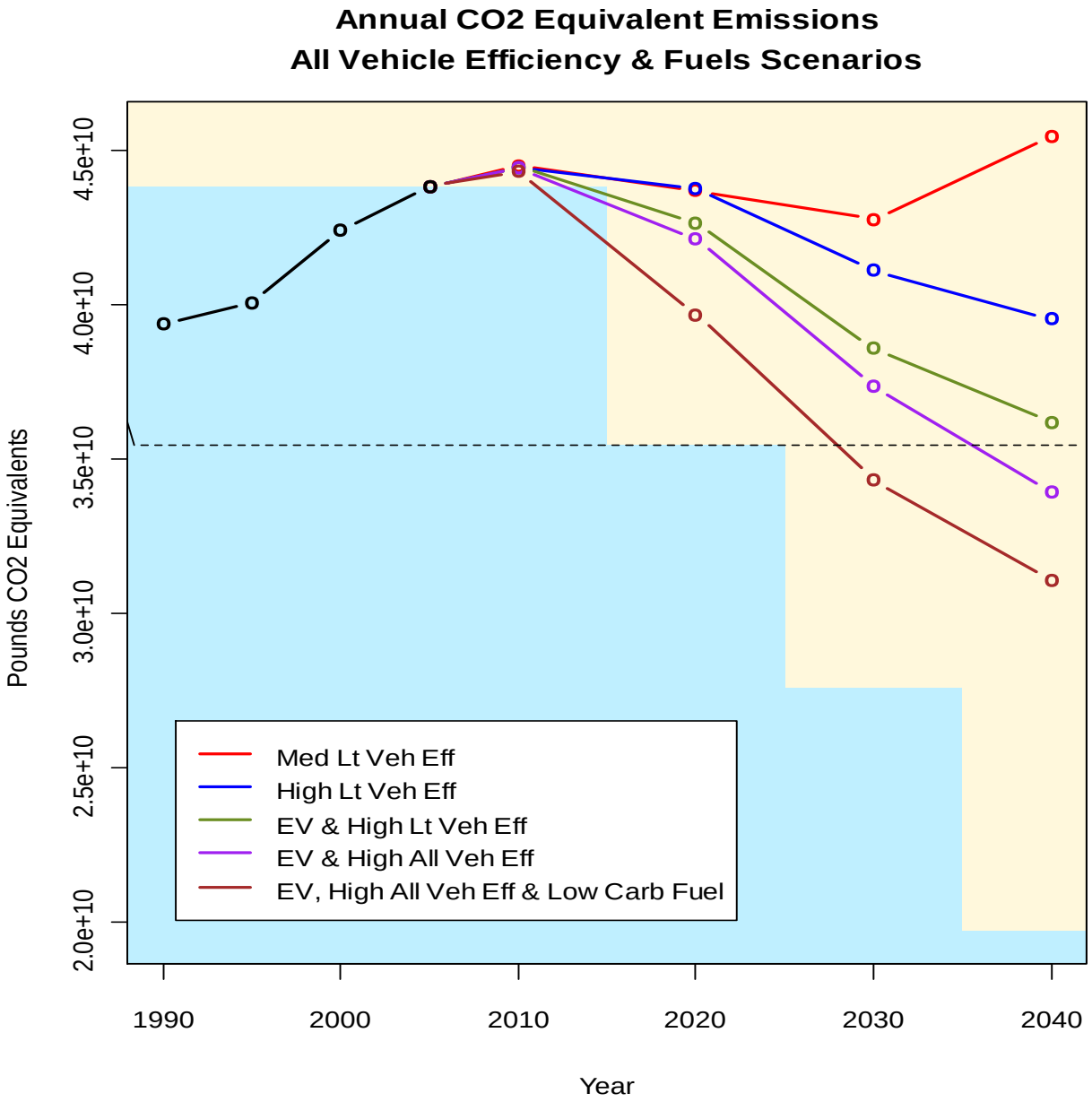


How do you make behavioral models sensitive to macro level trends?



Example GreenSTEP Version 1 Outputs


Annual CO2 Equivalent Emissions
Density Scenarios
Pounds CO2 Equivalents
2.0e+10
2.5e+10
3.0e+10
3.5e+10
4.0e+10
4.5e+10
1990
2000
2010
2020
2030
2040
Year
Med Lt Veh Eff
Med Lt Veh Eff & More Den
Med Lt Veh Eff, More Den & More PT


Annual CO2 Equivalent Emissions
All Vehicle Efficiency & Fuels Scenarios
Pounds CO2 Equivalents
2.0e+10
2.5e+10
3.0e+10
3.5e+10
4.0e+10
4.5e+10
1990
2000
2010
2020
2030
2040
Year
Med Lt Veh Eff
High Lt Veh Eff
EV & High Lt Veh Eff
EV & High All Veh Eff
EV, High All Veh Eff & Low Carb Fuel

Next Steps

- Complete version 2 of the light vehicle model
- Complete long-distance travel model
- Develop multimodal freight model
- Apply GreenSTEP in development of statewide transportation strategy for reducing GHG emissions

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